Investigation 3

Rules and Equations

In the last investigation, you used tables and graphs of relationships to find values of one variable for given values of the other variable. In some cases, you could only estimate or predict a value.

For some relationships, you can write an equation, or formula, to show how the variables are related. Using an equation is often the most accurate way to find values of a variable.

In this investigation, you will use the patterns in tables to help you write equations for relationships. You will then use your equations to compute values of the dependent variable for specific values of the independent variable.

3.1 Writing Equations

On the last day of the Ocean Bike Tour, the riders will be near Wild World Amusement Park. Liz and Malcolm want to plan a stop there. They consider several variables that affect their costs and the time they can spend at Wild World.

Getting Ready for Problem 3.1

- What variables do you think are involved in planning for the amusement-park trip?
- How are those variables related to each other?

Malcolm finds out that it costs $21 per person to visit Wild World. Liz suggests they make a table or graph relating admission price to the number of people. However, Malcolm says there is a simple **rule** for calculating the cost:

The *cost* in dollars is equal to 21 times the *number of people.*

He writes the rule as an **equation**:

$cost = 21 \times number\ of\ people$

Liz shortens Malcolm's equation by using single letters to stand for the variables. She uses c to stand for the cost and n to stand for the number of people:

$c = 21 \times n$

When you multiply a number by a letter variable, you can leave out the multiplication sign. So, $21n$ means $21 \times n$. You can shorten the equation even more:

$c = 21n$

The equation $c = 21n$ involves one calculation. You multiply the number of customers n by the cost per customer $21. Many common equations involve one calculation.

Problem 3.1 Equations With One Operation

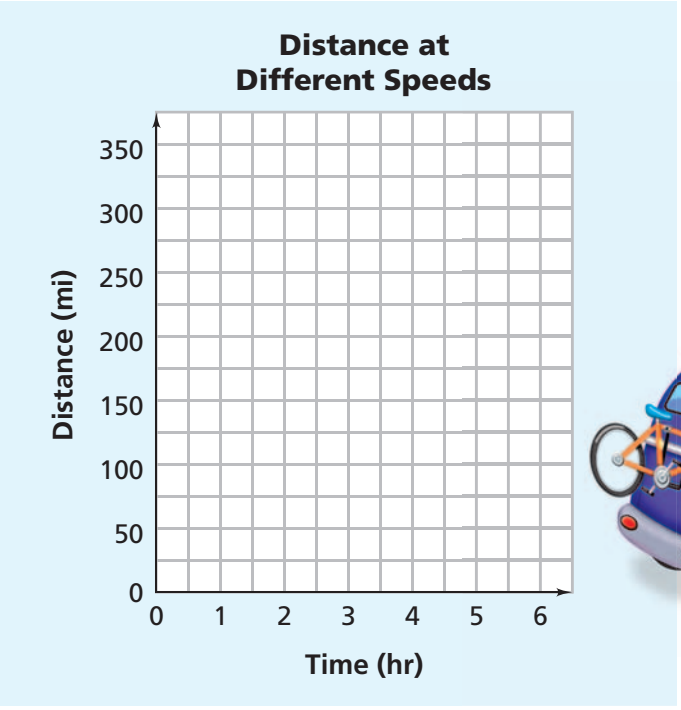
The riders visited Wild World and the tour is over. They put their bikes and gear into vans and head back to Atlantic City, 320 miles away. On their way back, they try to calculate how long the drive home will take. They use a table and a graph to estimate their travel time for different average speeds.

A. Copy and complete the table.

Distance Traveled at Different Average Speeds

Time (hr)	Distance for Speed of 50 mi/h	Distance for Speed of 55 mi/h	Distance for Speed of 60 mi/h
0	0	■	■
1	50	■	■
2	100	■	■
3	■	■	■
4	■	■	■
5	■	■	■
6	■	■	■

B. Copy and complete the graph for all three speeds below. Use a different color for each speed.



C. Do the following for each of the three average speeds:

1. Look for patterns relating distance and time in the table and graph. Write a rule in words for calculating the distance traveled in any given time.

2. Write an equation for your rule, using letters to represent the variables.

3. Describe how the pattern of change shows up in the table, graph, and equation.

D. For each speed, (50, 55, and 60 mph) tell how far you would travel in the given time. Explain how you can find each answer by using the table, the graph, and the equation.

1. 3 hours **2.** $4\frac{1}{2}$ hours **3.** $5\frac{1}{4}$ hours

E. For each speed, find how much time it will take the students to reach these cities on their route:

1. Atlantic City, New Jersey, about 320 miles from Norfolk

2. Baltimore, Maryland, about $\frac{3}{4}$ of the way from Norfolk to Atlantic City

ACE **Homework starts on page 55.**